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(54) Improvements in bicycle frames and bicycles

(57) A bicycle frame that combines the desirable features of a diamond frame and a small wheel-type frame has a rear diamond frame 10, 24, 26, 18 connected at its front vertex 11 to the lower end of the head tube 36 by means of a single tube-like strut 34 only. A hinge 30, 32, 16 is provided to enable folding of the frame.

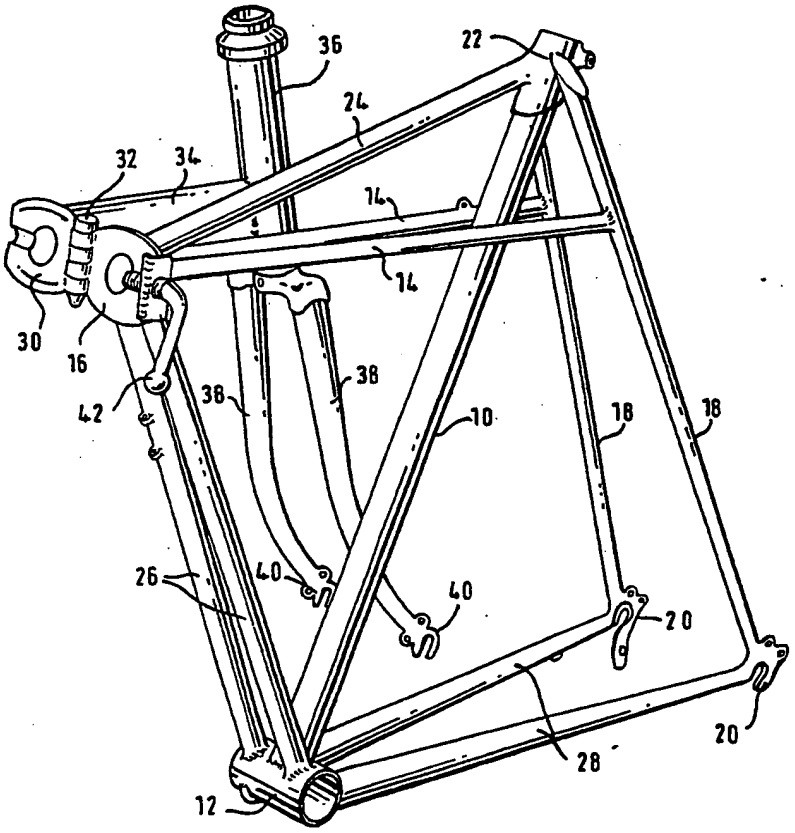

FIG.2

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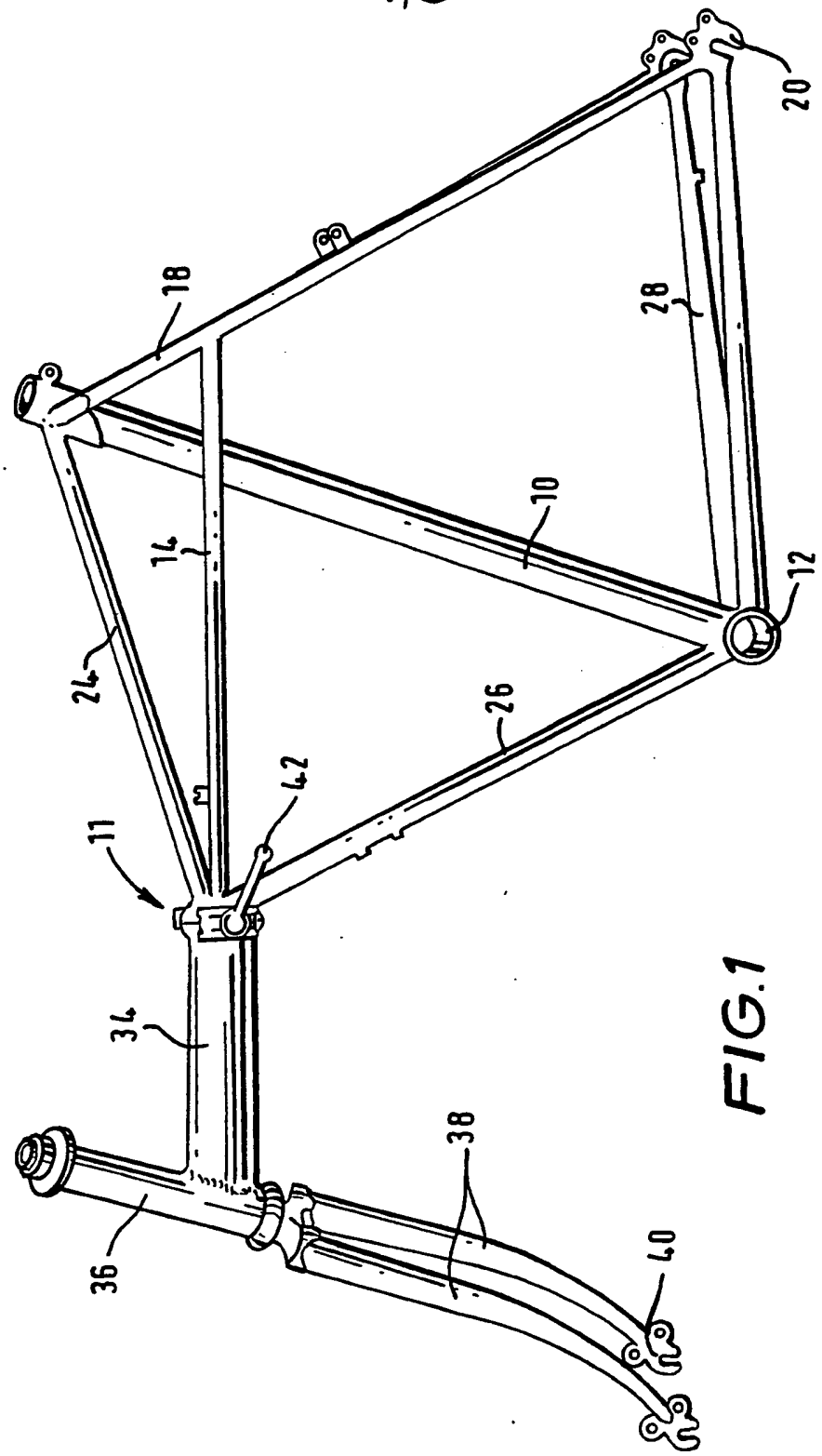

FIG.1

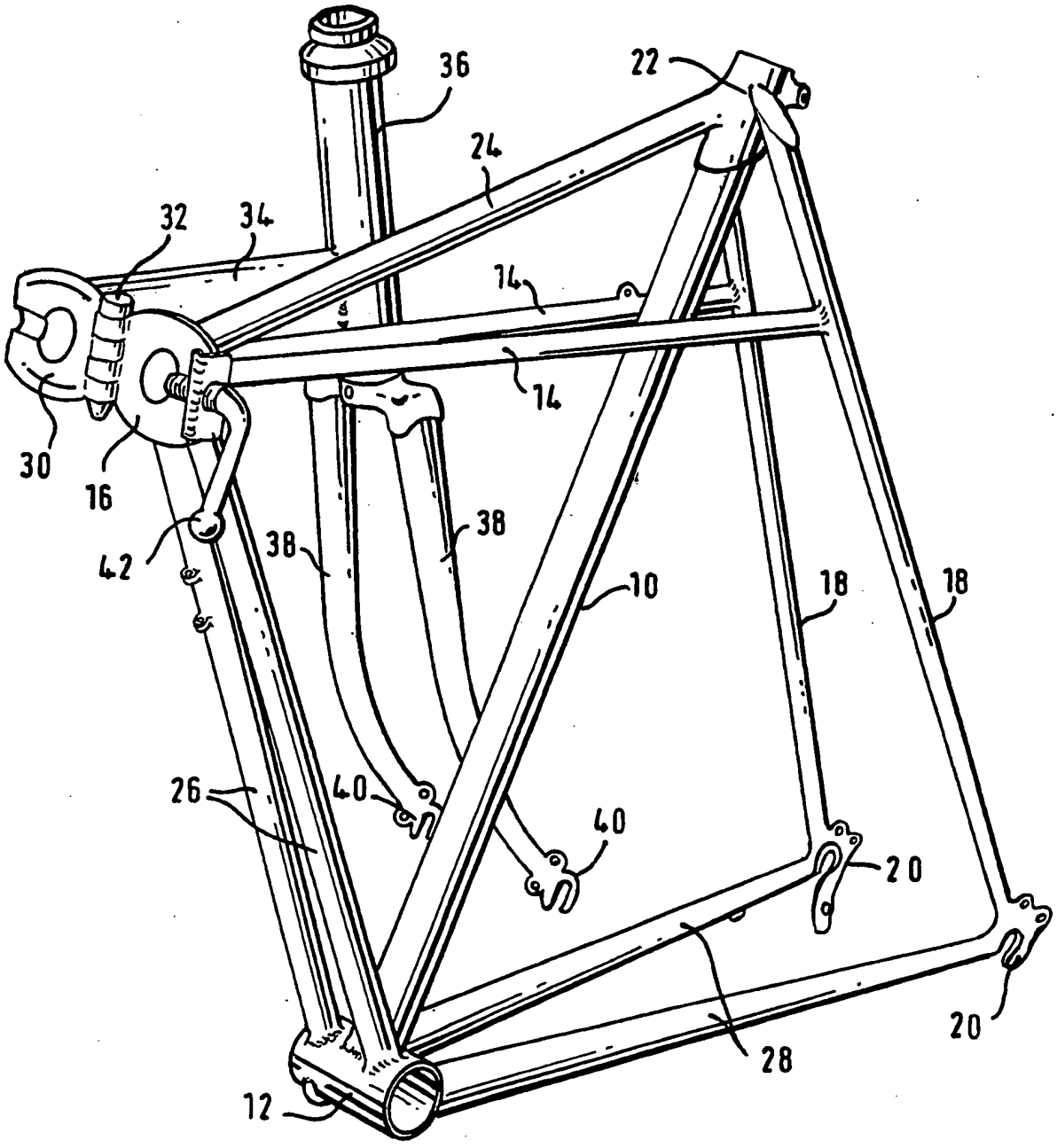

FIG. 2

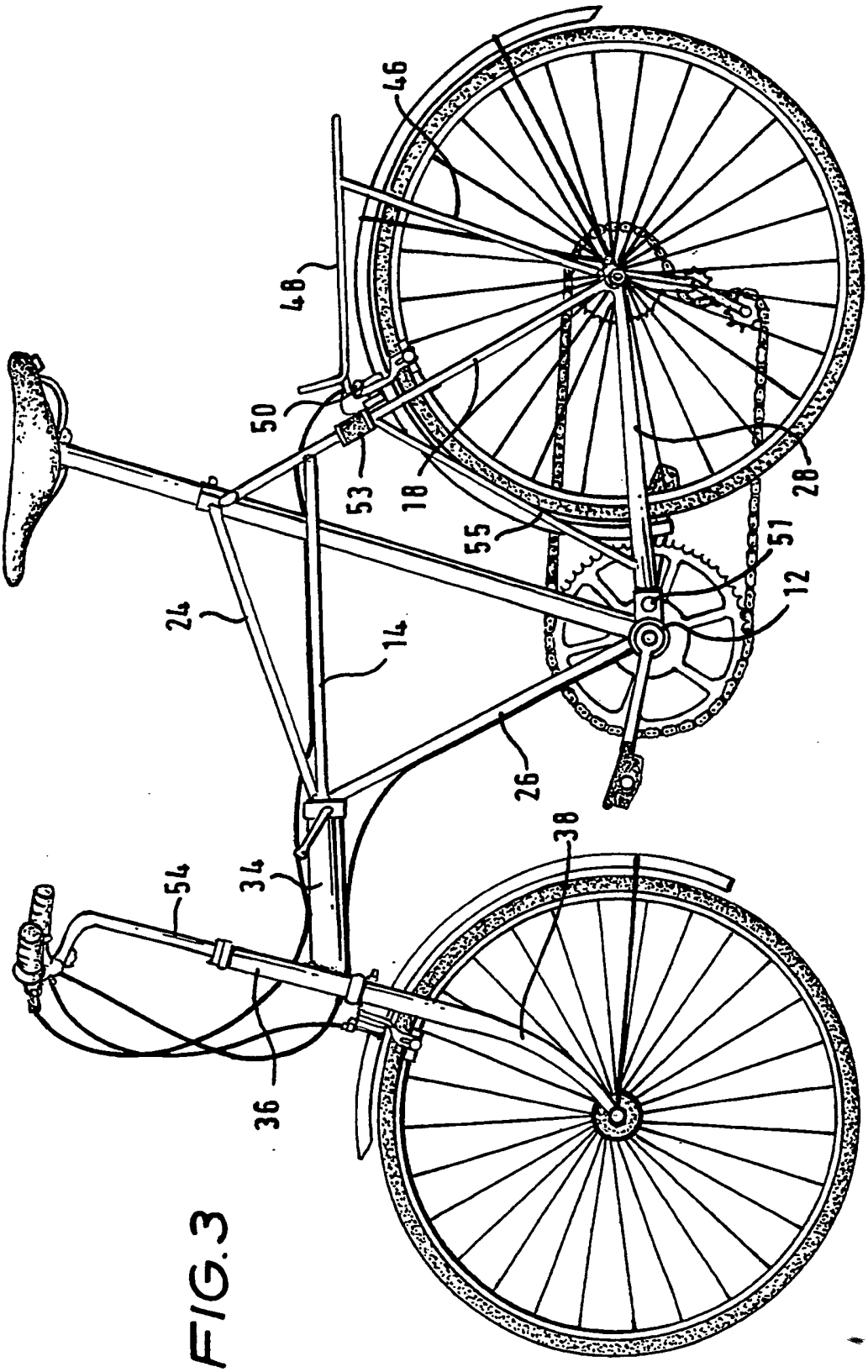

FIG.3

SPECIFICATION

Improvements in bicycle frames and bicycles

The present invention relates to an improved bicycle frame and to a bicycle fitted with such a frame.

The traditional diamond frame bicycle having (for adults) wheels of 26 or 27 inches radius has remained unchanged in fundamental design since about 1900. It has an obtrusive top-tube and does not readily lend itself to folding. Folding bicycles as popularised by Alex Moulton have been based on small wheels (less than 20 inches in radius). Such bicycles usually employ a single main tube to span between the steering head tube and the seat tube with a folding mechanism built into that main tube. But the main tube has to be stiff enough to resist pedalling and other loads that in the diamond frame bicycle are absorbed in a frame of considerable dimensions and it has to be made of heavy gauge metal to carry out its intended function. Portable small-wheel bicycles are generally regarded as shopping/commuting cycles and so made as cheap, heavy bicycles which lack the quality lightweight constructions of sports bicycles. Furthermore, the reduced wheel size makes it more difficult to negotiate obstructions and absorb shocks.

It is an object of the invention to provide a bicycle frame that combines the best features of the diamond frame and small-wheel bicycles and is relatively light in weight. It is another object of the invention to provide a bicycle frame that has the advantages of the diamond frame but can be made to fold without unacceptable weight penalty.

Broadly stated, the invention provides a bicycle frame including a head tube for pivotally supporting a front steering fork assembly and a seat post behind the head tube, a single front tube attached to the head tube spanning part of the distance to the seat post and attached at its rear end to a front vertex of a frame structure spanning the remainder of the distance to the seat post, said frame structure including at least two pairs of tubes disposed in side-by-side relationship and extending from the front vertex in different angular directions towards the seat tube.

The invention also provides a bicycle frame including a head tube for pivotally supporting a front steering fork assembly and a seat post behind the head tube, said frame having a rear portion formed from tubes or pairs of tubes converging from three different angular directions towards a vertex located between the head tube and the seat post at which vertex a front frame portion is attached that spans the remaining distance to the head tube, there being at least two pairs of tubes disposed in sideside relationship and the tubes in at least one pair meeting opposed sides of the seat tube and attaching to respective seat bracing tubes extending rearwardly and downwardly from the seat tube.

The rear end of the front tube may be attached to the front vertex by means permitting the front tube to hinge about a generally vertical axis relative to the frame strucutre, with a releasable catch to hold or latch the front tube in its extended or ready-to-ride position. A rear plate of the hinge may provide a rigid anchorage for the tubes forming the rear frame structure. In a preferred construction three tubes or sets of tubes effectively fan out from the front apex towards the seat tube. Thus down tube means extends from the front vertex to meet a bottom bracket shell at the lower end of the seat tube, bracing tube means extends horizontally from the front vertex to meet the seat post at an intermediate position therealong and upwardly inclined (as viewed from the front) top tube means extends from the front vertex to meet the top of the seat tube. The bracing tube means and the down tube means each consists of a pair of tubes disposed in side-by-side relationship, the bracing tubes being attached to opposed sides of the seat post. A pair of seat stays extends in conventional manner in side-by-side relationship from the top of the seat post, but the bracing tubes meet and are attached to respective seat stays. With this arrangement, the hinge is incorporated as an integral part of a box frame structure which is stiff as a whole but can be made from light tubing. The hinge plate (or in a non-folding version a junction plate) acts as a convergence point for a number of tubes and create strength and stiffness in the frame between the saddle and the bottom bracket shell which is where a conventional diamond frame will flex under hard pedalling effort.

The front tube is very preferably attached at or adjacent to the lower end of the head tube, the bracing tubes being generally horizontal in side view and aligned with the front tube. As viewed from the saddle the top tube is downwardly directed and it and the front tube are less obtrusive than on a diamond framed bicycle.

It may be desired to build a suspension unit into the frame to improve the ride. The rear seat stays may be divided below the bracing tubes into upper and lower portions interrupted by resilient suspension means, a pair of chain stays pivoted adjacent the bottom bracket shell extending reardwardly to meet the lower ends of the rear seat stays, and bracing means extending between the top of the lower portion of each rear seat stay and the forward end of the chain stay.

An embodiment of the invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a side view of a bicycle frame in its ready to ride state;

Figure 2 is a view of the frame in its folded state; and

Figure 3 is a side view of a complete bicycle incorporating the frame shown in Figures 1 and 2.

In the drawings a butted seat tube 10 of normal proportions (22 inches per standard diamond frame measurement 1 1/8 inches in diameter) is fastened at its lower end to a bottom bracket shell 12 and at its upper end passes between a pair of horizontal bracing tubes 14 I 1/2 inches diameter, 20 gauge, that in turn are secured between a hinge plate 16 and a pair of rear seat stays 18 (13 mm

diameter, 20 gauge). Rear drop-out brackets 20 at the lower ends of stays 18 support a 24 inches diameter rear wheel. It will be noted that this is a conventional diamond frame wheel size. The seat tube 10 is rigidly connected through short bracing pieces to the bracing tubes 14 and extends upwardly therefrom to terminate in a seat post bracket 22 that receives a seat post in conventional manner and is also rigidly secured to rear stays 18. A top tube 24 (5/8 inch diameter, 20 gauge) extends forwardly and downwardly from the bracket 22 to meet the hinge plate 16. A pair of laterally spaced down tubes 26 (5/8 inch diameter, gauge) are fastened between hinge plate 16 and bottom bracket shell 12 and a pair of chain stays 28 (14 or 16 gauge oval) extends in conventional manner from bracket shell 12 to rear drop-out brackets 20. The downwardly directed top tube 24 is substantially less obtrusive to the user than the horizontal top tube of a conventional diamond framed bicycle. The top tube 24, bracing tubes 14, seat tube 10 and down tubes 26 form a box structure that can be made light in weight, but is stiff to resist pedalling forces and moreover the bracing tubes 14 extend rearwardly of the seat post 10 to meet and brace the seat stays 18, creating extra rigidity for a rear carrier.

A front hinge plate 30 pivoted at 32 to the hinge plate 16 has secured thereto a horizontal front tube 34 of 2 inches by I inch flat oval gauge or other non circular cross-section that is welded and filleted to a head tube 36 (1 1/4 inches diameter, 20 gauge) from which depend front forks 38 of Reynolds taper gauge tubing and front drop-out brackets 40 in conventional manner. The front wheel size is the same as that of the rear wheel. A locking lever 42 is provided for locking and releasing the hinge 30, 16, 32. It is understood, of course, that the diameters and gauges given are for the purpose of illustration and exemplification only.

Referring now to Figure 3 which shows a complete bicycle, carrier struts 46 extend upwardly from an eye formed in rear drop-outs to a carrier 48 that is fastened at 50 to the seat stays 18. The carrier 48 is lower than in a conventional diamond frame bicycle because of the slightly reduced wheel size used and can be made wider than usual because of the greater loads that it can accept without interfering with the handling of the machine. In the preferred rear carrier design two struts project forward, each fastened to a seat stay for stiffness. A rear carrier has been illustrated, but, of course, a front carrier could be fitted if so desired.

The hinge plates 16, 30 are for the folding version of the bicycle, but for rigid frame versions a single plate or other rigid member welded or otherwise rigidly secured to tubes 34, 26, 24, 14 could be employed.

It will be noted that the head tube 36 is lower, typically by about 2 inches, than in a conventional adult diamond frame bicycle and the handlebar stem 54 is correspondingly extended. As the bicycle is ridden the bending forces in the rear part of the frame are kept separate from the steering head of the bicycle with the result that the steering head and front forks act principally to support and steer the bicycle without being so subjected to frame bending stresses. Also in Figure 3, which shows the use of a rubber suspension, the chain stays 28 are pivoted at 51 adjacent the lower bracket 12 and the rear braces 18 are interrupted by a rubber suspension unit 53, the lower portion of the rear braces being buttressed by struts 55 (of 5/16 inch carrier tube).

The above frame structure may be incorporated into a lightweight, general purpose bicycle for commuting, leisure and touring use that has the trimmed weight, responsive feel and high-pressure tyres of good sports machines; yet it is a folding bicycle that weighs 5 to 7 lbs less than the average folding bicycle and gives a much better ride. It may be fitted with an unusually wide, purpose-made carrier so that luggage, shopping or camping gear (in conjunction with a front carrier) can be carried safely without the need for panniers. The carrier may be attached at its top end to the seat stays and at its lower end to eyes adjacent the rear drop-outs, thereby giving four point fixing and a very rigid structure. Lugs may extend from each seat stay to provide the fixing. The carrier is three to four inches lower than on conventional diamond frame machines, because of the smaller wheels, which gives a more stable centre of gravity under load. Being relatively light, the bicycle can be lifted more easily into a car boot, or carried upstairs to a flat. Its length, 6 inches shorter than a standard 27 inch wheel bicycle makes it easier to negotiate stair landings and it takes up less space even when unfolded.

The machine has no conventional crossbar and is intended to be ridden by both sexes. A wide range of saddle adjustment incorporated in the design enables the bicycle to be used by riders varying from older children to 6 foot adults.

The basic frame can be built easily by a skilled cycle frame builder from stock lightweight tubing. The only tooling needed for series production is inexpensive adaptation of a standard framebuilding jig. The rear suspension version of the frame - essentially incorporating a rubber shock absorber - requires only two parts that have to be specially made: a bonded rubber suspension unit, and a pivot bush.

CLAIMS

1. A bicycle frame including a head tube for pivotally supporting a front steering fork assembly and a seat post behind the head tube a single front tube attached to the head tube spanning part of the distance to the seat post and attached at its rear end to a front vertex of a frame structure spanning the remainder of the distance to the seat post, said frame structure including at least two pairs of tubes disposed in side-by-side relationship and extending from the front vertex in different angular directions towards the seat tube.

2. A bicycle frame according to claim 1, wherein the rear end of the front tube is attached

to the front vertex by hinge means permitting the front tube to hinge about a generally vertical axis relative to said frame structure and releasable means for latching the front tube in its extended position.

3. A bicycle frame according to claim I or 2, wherein the front tube is attached at or adjacent the lower end of the head tube.

4. A bicycle frame according to any preceding claim, wherein down tube means extends from the front vertex to meet a bottom bracket shell at the lower end of the seat tube, bracing tube means extends from the front vertex to meet the seat post at an intermediate position therealong and upwardly inclined top tube means extends from the front vertex to meet the top of the seat tube.

5. A bicycle frame according to claim 4, wherein said bracing tube means and said down tube means each consist of a pair of tubes disposed in side-by-side relationship, the bracing tubes being attached to opposed sides of the seat post.

6. A bicycle frame according to claim 5, wherein a pair of seat stays disposed in side-by-side relationship extends rearwardly and downwardly from the top of the seat post and the bracing tubes meet and are attached to respective seat stays.

7. A bicycle frame according to claim 6, wherein the rear seat stays are divided below the bracing tubes into upper and lower portions interrupted by resilient suspension means a pair of chain stays pivoted adjacent the bottom bracket shell extend rearwardly to meet the lower ends of the rear seat stays and bracing means extends between the top of the lower portion of each rear seat stay and the forward end of the chain stay.

8. A hinged or hingeless bicycle frame substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

9. A bicycle having wheels of about 24 inches diameter and a frame as claimed in any of claims 1 to 8.

10. A bicycle frame including a head tube for pivotally supporting a front steering fork assembly and a seat post behind the head tube, said frame having a rear portion formed from tubes or pairs of tubes converging from three different angular directions towards a vertex located between the head tube and the seat post at which vertex a front frame portion is attached that spans the remaining distance to the head tube, there being at least two pairs of tubes disposed in side-by-side relationship and the tubes in at least one pair meeting opposed sides of the seat tube and attaching to respective seat bracing tubes extending rearwardly and downwardly from the seat tube.

11. A bicycle frame as claimed in claim 10, wherein hinge means at the vertex attaches the front and rear portions of the frame for hinging about a generally vertical axis and releasable means latches the front tube in its extended position.

12. A bicycle consisting of a generally diamond frame connected at its front vertex to the lower end of the head tube via a single tube-like strut only.

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